REMARKS

In the Office Action, the Examiner noted that claims 1-14 are pending in the application and that claims 1-14 stand rejected. Claims 1 and 9 are amended herein to more clearly define the invention of the Applicant and not in response to prior art.

In view of the amendments presented above and the following discussion, the Applicant respectfully submits that none of these claims now pending in the application are anticipated under the provisions of 35 U.S.C. § 102. Thus the Applicant believes that all of these claims are now in allowable form.

Rejections

A. 35 U.S.C. § 102

The Examiner rejected claims 1-14 under 35 U.S.C. § 102(e) as being anticipated by Dye et al. (U.S. Patent 6,567,091, hereinafter "Dye"). The rejection is respectfully traversed.

The Applicant submits that the Dye reference fails to teach, suggest or anticipate each and every element of at least the invention as recited in the Applicant's amended claim 1, which specifically recites:

> "A method for estimating light sources in a common support space when merging in said common support space at least two visual data sets respectively previously associated with at least one individual support space and having a position, a dimension and a size in the common support space, said method comprising the steps of:
> determining the position of light sources in the common support space in accordance with said position, said dimension and said size of at least one of the individual support spaces; and,
> determining a color distribution for each of said light sources in the common support space according to at least one of said two visual data sets."

Referring to claim 1, a light source is defined by its position in the common support space and its color distribution. A light source is a source of light that illuminates objects in a scene or in a visual data set. The Applicant, in the Specification, clearly specifies on page 8 lines 29 to 33, that a light source provokes photometric effects (e.g. shadowing, specular reflection and cast shadows) on the objects in a scene that it illuminates. The Applicant strongly asserts that a light source should not be confused with an illuminated pixel. The notion of light source is known by

those skilled in the art and the wording itself has been widely used. The Applicant refers to the documents cited in the specification. For example, refer to figure 1 (bottom of left column on page 449) of document from Pentland published in April 1982 in the "journal of optical society of America", vol.72, n°4, entitled "finding the illuminant direction". In addition one can refer to figure 1 in a document from Mukawa published in volume 23 of "Systems and Computers in Japan", pages 92 to 99, and entitled "estimation of light source information from image sequence". A light source is further well-known in OpenGL community as cited by the specification. Since a scene may be 2D or 3D or more generally n-D so is the light source. A light source may thus also be 2D. For example if a 3D scene comprises a light source (e.g. the sun) then an image captured from this scene by a camera itself comprises a 2D light source which is a projection of the scene's 3D light source. In this case, the captured image comprises 2D objects (projections of the 3D objects of the scene) and at least one light source, this light source being responsible for the photometric effects (e.g. shadowing, specular reflection and cast shadows) occurring in the captured image objects.

As such, the Applicant submits that a light source can not be mixed up with any other notion such as pixel intensities or an image streaking across a display. In addition, the Applicant submits that a visual data set is a representation of a scene or a part of the scene as viewed by an observer. There are no restrictions on the dimension of either the visual data set or the scene. Therefore, the scene can be 3D and the visual data set may be 2D, but the visual data set can also be 3D if captured by a 3D camera for example. The scene itself and the visual data set can also be 2D. The only difference is that the visual data set is a representation of the scene as captured by an observer, e.g. a camera. In the case in which a scene comprises a first observer and a second observer, the scene as viewed by the first observer may include the other observer. Therefore, the visual data set representing the scene as viewed by the first observer also contains observers, light source (resulting from the projection of the light source in the original scene) and objects but is different from the scene itself. This situation is quite usual in the film production domain, where a scene is captured by different cameras.

Therefore, the Applicant submits that as evident from the Applicant's claim 1 presented above, the Applicant clearly defines that the invention of the Applicant is directed at least in part to merging into one common support space at least two visual data sets and to **determine the light sources characteristics** (i.e. position and color distribution) in the common support space according to this visual data sets.

In contrast to the invention of the Applicant, there is absolutely no light sources estimation step in Dye. Dye instead teaches only object properties (position, color depth i.e. color precision, depth, alpha buffer i.e. transparency). In contrast to Dye, the invention of the Applicant teaches and claims light source properties (light source position, light color distribution). These are physically different elements. Dye teaches far away from the problem of photometric effects and therefore cannot be considered as anticipating the invention of the Applicant. For example, when mixing two images of the same scene captured by two cameras from different locations with the method of Dye, no modification of the visual effect can be achieved, while if a light source estimation step was made as taught and claimed by the Applicant, the visual effect on the mixed image can be modified on the basis of the estimated light source(s) in order to render coherent photometric effects, especially the cast shadows.

Therefore and as described above, the Applicant's submits that he has clarified the notion of light source and that the notion of light source as taught and claimed by the Applicant should not be mixed up with the notion of pixel intensities, color depth, alpha values as taught in Dye. In addition, the Applicant submits that the notion of a visual data set as taught and claimed by the Applicant should be mixed up with a scene as taught in Dye.

As such and for at least the reasons recited above, the Applicant submits that Dye absolutely fails to teach each and every element of the Applicant's claims arranged as in the Applicant's claim as required for anticipation. More specifically, the Applicant submits that Dye absolutely fails to teach "determining the position of light sources in the common support space in accordance with said position, said dimension and said size" and "determining a color distribution for each of said light sources in the common support space according to at least one of said two visual data sets" as taught and claimed by the Applicant.

Therefore, the Applicant submits that for at least the reasons recited above independent claim 1 is not anticipated by the teachings of Dye and, as such, fully satisfies the requirements of 35 U.S.C. § 102 and is patentable thereunder.

Likewise, independent claim 9 recites similar relevant features as recited in the Applicant's independent claim 1. As such, the Applicant submits that for at least the reasons recited above independent claim 9 is also not anticipated by the teachings of Dye and also fully satisfies the requirements of 35 U.S.C. § 102 and is patentable thereunder.

Furthermore, dependent claims 2-8 and 10-14 depend directly from independent claims 1 and 9, respectively, and recite additional features therefor. As such and for at least the reasons set forth herein, the Applicant submits that dependent claims 2-8 and 10-14 are also not anticipated by the teachings of Dye. Therefore the Applicant submits that dependent claims 2-8 and 10-14 also fully satisfy the requirements of 35 U.S.C. § 102 and are patentable thereunder.

Furthermore, the Applicant submits that the Applicant's invention is directed at least in part to a method for estimating light sources in a common support space having at least one visual data set respectively associated with at least one individual support space having a position in the common support space where the position of the light sources is determined according to the position, the dimension and the size of the individual support space associated with said at least one visual data set.

More specifically and referring to the invention of the Applicant, a scene (including real world scene, computer graphics generated scene and support spaces) is composed of objects (including windows on a screen, reflection color, transparency), light sources (including light distribution, color, source position etc) and observers (including human eye, real camera, computer graphics rendering). Thus, the Applicant respectfully submits that objects, light sources and observers are distinct elements. All of these three elements (objects, light sources and observers) have at least two properties: geometric aspects (position, size, depth, etc) and photometry (intensity, color). The Applicant respectfully points out that geometric and photometric aspects are distinct characteristics.

With respect to the invention of the Applicant, the Examiner alleged that claim 1 is anticipated by Dye figures 16, 17 and col. 34 line 63 to col. 35 line 22. The Applicant respectfully disagrees. As presented above, the Applicant's claim 1 addresses the "determination of light sources" and "determination of color distribution of light sources". This topic is not addressed by Dye. Dye is directed to only object properties (position, color depth i.e. color precision, depth, alpha buffer i.e. transparency). In contrast, the Applicant's invention is directed to light source properties (light source position, light color distribution). These are physically different elements. Thus the Applicant respectfully submits that the Applicant's claim 1 is not anticipated by the teachings of Dye.

As previously argued, the Applicant respectfully submits that visual data sets can contain objects, light sources and observers. As such, if visual data sets do contain pixel intensity and geometry information (as in windows on screen addressed by Dye), the visual data set is in fact the result of observation of objects and light, i.e. the output of an observer. In contrast to Dye, the Applicant's invention claims estimating light source properties from visual data sets. In case of visual data sets being pixel values, this means estimation of light source properties from pixel values. Instead the Applicant respectfully submits that pixels and light sources are distinct.

As such, the Applicant submits that Dye teaches away from the problem of photometric effects and therefore cannot be considered as anticipating the invention of the Applicant, at least with regards to the Applicant's claim 1.

More specifically, in support of the Applicant's invention, at least as claimed by the Applicant's claim 1 recited above, the Applicant in the Specification, specifically recites:

> "Advantageously, the position of the light sources depends on former positions of the light sources when at least one of said visual data sets is dynamic.
>
> This avoids unnecessary calculations when the visual data set is for example a video. In this case, the light sources position of the previous frames can be kept for the at least following frame." (See Applicant's Specification, page 4, lines 11-16).

And

> "The light source estimation modules 5 and 6 estimate the light sources of the different visual data sets in their own support space as described further in this document.

> Once the light source estimation modules have estimated the light sources number, position and spatial color distribution, the visual data sets are sent to the rendering means 7 which project the visual data sets into a for example two-dimensional display using the light source estimation module information. The rendering means 7 can be an OpenGL graphics stack (OpenGL is a trademark of Silicon Graphics Incorporated) on a personal computer graphics card or any other system or method for image synthesis.
>
> An OpenGL stack performs the geometric and photometric projection of visual data of two or three dimensions onto a two dimensional display plane.
>
> The geometric projection determines the position and geometric transformation of the visual data. The photometric projection determines the appearance of the visual data including photometric effects. Using the light sources, the OpenGL stack can generate photometric mutual effects as for example shadowing, specular reflection and cast shadows. Other photometric effects can also be considered." (See Applicant's Specification, page 8, line 12-33).

It is clear from at least the portions of the Applicant's disclosure presented above that the Applicant's invention, at least with respect to claim 1, is directed, at least in part, to a method to estimate light sources in a common support space where the position of the light sources is determined according to the position, the dimension and the size of the individual support space associated with said at least one visual data set. That is, and as presented above, in the invention of the Applicant, light source estimation modules estimate the light sources of the different visual data sets in their own support space. Once the light source estimation modules have estimated the light sources number, position and spatial color distribution, the visual data sets are sent to the rendering means which performs the geometric and photometric projection of visual data of two or three dimensions onto a two dimensional display plane. The geometric projection determines the position and geometric transformation of the visual data and the photometric projection determines the appearance of the visual data including photometric effects. Using the light sources, the photometric mutual effects are then generated.

In contrast to the invention of the Applicant, Dye teaches a graphics controller which performs display list-based video refresh operations that

enable objects with independent frame rates to be efficiently assembled. In Dye the graphics controller maintains a virtual display refresh list (VDRL) comprising a plurality of pointers to scan line segments in memory. The graphics controller also creates, maintains, and deletes draw display lists (DDLs) that comprise pointers to object display list subroutines (ODLs) that independently draw objects in memory. The ODLs allocate one or more buffers in memory into which different frames of the objects are drawn. When an ODL has completed executing, the corresponding pointer in the DDL may be updated to point to the buffer location in memory that stores the newly completed object frame. The VDRL is maintained independently (and may be doubled-buffered) and is updated using the DDLs. Motion estimation may be performed by the graphics controller using the different frames of objects that are drawn into memory by the ODLs. (See Dye, Abstract).

However, the Applicant respectfully submits that there is absolutely no teaching, suggestion or disclosure in Dye for a method to estimate light sources in a **common support space** where the position of the light sources is determined according to the position, the dimension and the size of the individual support space associated with said at least one visual data set as taught in the Applicant's Specification and claimed by at least the Applicant's claim 1. The Examiner specifically cites FIGs. 16 and 17 and the teachings of col. 34 and col. 35 of Dye for anticipating the Applicant's invention of at least claim 1. However, with respect to FIGs. 16 and 17 and col. 34 and col. 35 as pointed out by the Examiner, Dye specifically recites:

> "FIG. 16 illustrates the display screen 142 including multiple windows and their relative positions. In this example, W0 or window 0, is the matte or the background window, and W1, W2 and W3 are windows which overlap each other within the base window W0. The comers of the windows are indicated by the positions. W0Y0, for example, is the first line of W0 and W2Y20 at the bottom is the last line of window W2, which is at Y position 20. The same positions are true with the X coordinates. This information is programmed by the driver software into the Windows Workspace area of the system memory 110.
>
> FIG. 17 illustrates a single raster scan line roughly corresponding to the display screen 142 of FIG. 16 and the result when the display

> refresh list method is used. The display refresh list method of the present invention allows the software window managers or drivers to have independent control of each application's color, position depth, and blending functions as well as individual control of indexed color. FIG. 17 presumes that there are four different process windows pointed to by Xn through Xn+3. Each of the four window workspaces contains the starting X/Y position of the window, the color depth, the Z depth, and the alpha value pointers. As shown, the first window is a single RGB direct color. The second window shows direct RGB color along with a depth buffer and an alpha buffer. The third window shows only a simple gray scale window while the fourth buffer shows gray scale with a depth buffer." (See Dye, col. 34, line 63 through col. 35, line 22).

In the passages described above, Dye teaches and describes, with reference to FIG. 16, a display screen including multiple windows and their relative positions. Dye further teaches and describes, in FIG. 17, a single raster scan line roughly corresponding to the display screen of FIG. 16 and the results of a display refresh list method. Specifically, Dye teaches that the display refresh list method of the invention allows the software window managers or drivers to have independent control of each application's color, position depth, and blending functions as well as individual control of indexed color. That is, in Dye the software window managers or drivers have control of the color distribution across the windows. However, there is absolutely no teaching, suggestion or disclosure in Dye for a method to estimate light sources in a common support space including "determ ining the position of light sources in the common support space in accordance with said position, said dimension and said size of at least one of the individual support spaces" as taught in the Applicant's Specification and claimed by at least the Applicant's claim 1. That is, Dye absolutely fails to teach, suggest or anticipate the positioning of the light sources according to the position, the dimension and the size of the individual support space associated with at least one visual data set as taught in the Applicant's Specification and claimed by the Applicant's claim 1.

Therefore, the Applicant submits that for at least the reasons recited above independent claim 1 is not anticipated by the teachings of Dye and, as such, fully satisfies the requirements of 35 U.S.C. § 102 and is patentable thereunder.

Likewise, independent claim 9 recites similar relevant features as recited in the Applicant's independent claim 1. As such, the Applicant submits that for at least the reasons recited above independent claim 9 is also not anticipated by the teachings of Dye and also fully satisfies the requirements of 35 U.S.C. § 102 and is patentable thereunder.

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Conclusion

The Applicant respectfully submits that none of the claims, presently in the application, are anticipated under the provisions of 35 U.S.C. § 102. Consequently, the Applicant believes that all these claims are presently in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

No fee is believed due. However, if a fee is due, please charge the additional fee to Deposit Account No. 07-0832.

Respectfully submitted,
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